Ontario Geological Survey

Northern Onta
Engineering Geology Terrain Study 85

BATCHAWANA AREA

(NTS 41N/SE)

District of Algoma

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D.E. McQuay

1980

Ontario

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Dr. J.K. Reynolds
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Ministry of Northern Affairs

Hon. Leo Bernier
Minister

Art Herridge
Deputy Minister

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THIS PROJECT WAS FUNDED BY
THE ONTARIO MINISTRY OF NORTHERN AFFAIRS
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THE ONTARIO MINISTRY OF NATURAL RESOURCES

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ISSN 0709-4671
ISBN 0-7743-4361-3

Parts of this publication may be quoted if credit is given. It is recommended that reference to this report be made in the following form:

McQuay, D.F.
1980: Batchawana Area (NTS 41N/SE), District of Algoma; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 85, 13 p. Accompanied by Map 5011, scale: 1:100 000.

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(accompanying report)

Map 5011 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, Batchawana (NTS 41N/SE). Scale 1:100 000.

Northern Ontario

Engineering Geology Terrain Study 85

BATCHAWANA AREA

(NTS 41N/SE)

District of Algoma

by

D.F. McQuay[1]

1.0 INTRODUCTION:

This report contains an inventory of regional engineering terrain conditions in the Batchawana area, District of Algoma. The area, which covers NTS block 41N/SE, lies between Latitudes 47°00'N and 47°30'N and Longitudes 84°00'W and 85°00'W. This report forms part of a series of publications which provide similar terrain data for some 370 000 km^2 of northern Ontario.

The purpose of the mapping is to provide a guide for engineering and resource planning functions at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5011, accompanying this report).

Interpretation of existing black and white aerial photographs, at a scale of approximately 1:54 000, was the primary method of obtaining this terrain information. The interpretation was compared with published and

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[1] Earth Scientist, Gartner Lee Associates Limited, Markham, Ontario.

Manuscript approved for publication by the Chief, Engineering and Terrain Geology Section, January 25, 1980. This report is published with the permission of E.G. Pye, Director, Ontario Geological Survey.

unpublished literature which documented previous field visits and observations. During the summer of 1977, roads in the area were traversed and observed terrain conditions recorded as further verification of the office studies. Thus, the map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further information on the mapping techniques, legend format, and possible uses of this terrain data is available in the "Ontario Engineering Geology Terrain Study Users' Manual" (Gartner, Mollard, and Roed 1980), a companion publication to this series of maps and reports.

2.0 GEOLOGICAL SETTING:

2.1 BEDROCK:

With the exception of a few small, off-shore islands in Lake Superior consisting of Cambrian sandstone, shale, and conglomerate, the entire map area is underlain by rocks of Precambrian age (Giblin and Leahy 1967). The rugged bedrock hills that predominate in the area are sparsely covered with overburden deposits and rock outcrops are common.

The major rock types in the northwestern half and southeastern part of the area are granite and syenite, with some zones of granite gneiss. These Early Precambrian felsic intrusive rocks have been given a "least" mineral rating potential by Springer (1977).

A broad belt of Early Precambrian metavolcanics trends northeasterly across the southern part of the map-area. These rocks, together with the Keweenawan sedimentary and volcanic rocks located east of Hibbard Bay in the southwestern corner of the area, have a high to medium mineral potential and host a variety of mineral occurrences, including copper, lead, zinc, silver, and gold (Springer 1977). Until recently, several mines in the southwestern part of this belt produced relatively large quantities of mainly copper ore. The most important were the Coppercorp Mine, located east of Hibbard Bay, and the Tribag Mine in Nicolet Township.

2.2 QUATERNARY:

The last glacial advance in the area was toward the south-southwest. Esker ridges, which are good indicators of ice movement directions during retreat of the ice front, are found in the northern part of the map-area. Glaciation of the area resulted mainly in deposition of thin, discontinuous, sandy ground moraine. This condition is typical of the vast majority of the area. There were no ice-contact morainal features noted in the area.

During deglaciation, meltwaters from decaying ice masses deposited sand and gravel in spillway channels. These meltwater channels were often larger versions of the present-day rivers in the area, and in a few places they broaden into flat outwash plains composed of granular materials. Examples of this occur south of the Montreal River near the Lake Superior shore and near the eastern margin of the map-area.

The lower ground, along the Lake Superior shore, below an elevation of about 300 m, was inundated toward the end of the Pleistocene by a high level, post-Algonquin glacial lake. As a result, raised beaches of sand and gravel were deposited. However, the high rocky shores along this part of Lake Superior were generally washed bare, and beach materials accumulated in only a few protected areas.

Since deglaciation, floodplain alluvium has been deposited along most of the rivers and streams. These materials are mainly silty sand and gravel. Organic deposits have accumulated in many depressions within the bedrock terrain and also along poorly drained river valleys.

3.0 ENGINEERING TERRAIN UNITS:

3.1 BEDROCK LANDFORMS:

3.1.1 Description:

Rock knob (RN) terrain is by far the dominant landform in the Batchawana map-area. Relative relief of the rugged bedrock hills is commonly in excess of 60 to 70 m. Numerous joints and faults in the rock contribute to the highly variable and complex topography. Spectacular canyons,

such as that of the Agawa River which is about 200 m deep, trace lineaments or faults in the bedrock.

The rock terrain is mantled by a thin, discontinuous layer of ground moraine. It is usually less than 1 m thick near the crests of the outcrops, but may thicken to as much as 3 m on the lower slopes and in valleys between bedrock hills. The till is sandy in texture, and cobbles and boulders are common. In general, the bedrock terrain is well drained, but localized organic bogs occur in depressions and occasionally in areas of low relief.

A typical letter code depicting the bedrock terrain is:

$$\frac{\text{RN(tMG)}}{\text{Hj-D}}$$

Rock knobs are the dominant landform, while ground moraine is a subordinate feature occurring as an intermittent veneer of till over the bedrock. Topography is rugged and jagged, and relative relief is high. The ground surface is well drained and dry.

At a few isolated locations, the ground moraine appears thicker and covers the bedrock uniformly. A letter code used to describe such areas is:

$$\frac{\text{tMG(RN, pOT)}}{\text{Mu-D}}$$

This indicates that ground moraine is the most common surface material. Rock knobs and organic terrain are associated subordinate landforms. Relief is moderately high and the topography is undulating. Surface drainage conditions are usually dry.

3.1.2 Significance:

RESOURCES: Portions of the rock can be used for crushed stone purposes, but detailed evaluations of suitability for aggregate use would be required. Ground water resources within the bedrock will be limited to fractures, faults, and fissures. The occurrence of aquifers is unpredictable and the terrain has only fair potential for ground water supplies.

Sources of borrow material for local use might be found in the few scattered areas of possible deeper, continuous till.

Bedrock terrain in the southern part of the map-area has high mineral potential. The appropriate published government maps, listed in the references for this report, should be consulted for further details.

GENERAL CONSTRUCTION: The rugged, irregular, and complex slopes of the bedrock terrain present major constraints for development and construction. Excavations, in most instances, will require blasting, and material handling in rock cuts and fills will be costly. Foundation bearing conditions should be excellent, but steep slopes present serious constraints for the siting of buildings. Locating transportation routes in the bedrock terrain is complicated by severe grades, potentially expensive cut-and-fill operations, and adverse horizontal alignments. The shallow soils that occur on the steep rock slopes are susceptible to erosion when cleared of vegetation.

WASTE DISPOSAL: Bedrock terrain is generally unsuitable for all types of waste disposal. Development of lagoons or tile fields would require costly rock handling and importation of soil fill. In addition, there is often insufficient cover material for sanitary landfills.

3.2 GLACIOFLUVIAL LANDFORMS:

3.2.1 Description:

Outwash plains or *valley trains* (GO) are the most common Quaternary landforms in the area. They are composed of sand and gravel, generally with a high proportion of sand. The deposits are often found in river valleys which were once major channels for glacial meltwater. In these settings, they occur as discontinuous but relatively level terraces that are interrupted by river alluvial plains and bedrock. With the exception of the deposits around the lower part of the Montreal River and extending south toward Pancake Lake, they are small or shallow and appear to have low aggregate reserves. Large terraces on the lower Montreal River indicate potentially deep granular deposits.

A typical letter code depicting these deposits and others immediately to the south is:

$$\frac{\text{sgGO}}{\text{Lpt-D}}$$

The landform is an outwash feature (GO) composed of sand and gravel, generally with a high proportion of sand. The relief is low and the ground surface is level and terraced. In general, good drainage conditions prevail and the surface materials are dry.

A comparatively large deposit near the eastern margin of the area appears to have low aggregate potential because of its association with bedrock knobs and wet surface conditions. The letter code for this unit is:

$$\frac{\text{sGO(RN, pOT)}}{\text{Lp-Dh(M)}}$$

It indicates that the outwash is the dominant landform and that the sediments are probably sandy in texture. Rock knobs and organic wetlands are scattered throughout the area. The unit has a generally level surface with low relief. Surface drainage conditions are dry, but a high water table is suspected. The subordinate landforms have mixed wet and dry surface drainage.

Letter codes such as

$$\frac{\text{sgGO(sgAP)}}{\text{Lpt-D(M)}}$$

indicate that the outwash along some of the river valleys is associated with alluvial plain sediments.

Eskers (GE) are generally shown by the graphic symbol (>>>>>), which implies single ridges of sand and gravel. These ridges are usually small, and probably do not exceed 5 or 6 m in height. In the southwestern and south-central parts of the map-area, esker complexes occur in association with other landforms, particularly outwash and ground moraine.

Letter codes portraying these situations are:

$$\frac{\text{sgGO(sgGE)}}{\text{Lpk-D}} \qquad \text{and} \qquad \frac{\text{gsGE, tsMC/R(RN, pOT)}}{\text{Ln-M}}$$

The latter code suggests a complex of sandy gravel esker ridges and sandy ground moraine that forms a shallow mantle over the bedrock. Associated subordinate landforms are rock knobs and organic wetlands. Relief is low, the topography is hummocky, and surface drainage conditions are mixed wet and dry.

3.2.2 Significance:

RESOURCES: Many of the outwash deposits represent good sources of sand and gravel for local use. Gravel pits have been developed in some of these deposits, and materials are probably used for general fill and road construction. The best deposits, which occur in the west-central part of the map-area, are generally accessible by existing roads. Most of the esker ridges are found in the remote northern part of the area; if developed, these should provide good sources of aggregate for local use.

GENERAL CONSTRUCTION: Glaciofluvial landforms generally provide good conditions for construction. Materials excavate and grade easily; bearing capacities for foundations, in most cases, should be adequate. Also, since many of the outwash deposits occur in river valleys, they provide the best overall conditions for locating route alignments.

In some instances, complex ground conditions present potential problems for construction. Where high water tables are suspected, dewatering of excavations might be necessary and foundations will require proper drainage works or elevating with fill. Excavations may encounter bedrock in areas of shallow overburden, thus increasing construction costs. Hummocky terrain, especially where esker complexes are present, may involve extensive grading as well as cut-and-fill operations.

WASTE DISPOSAL: Glaciofluvial landforms do not always provide the best sites for disposal of either solid or liquid waste. Disposal in such areas will have to deal with the possible contamination of both ground and surface waters. This is because glaciofluvial materials can be very permeable, allowing contaminants to migrate easily to nearby streams or to the water table. Careful investigations should be undertaken to determine the environmental impact of waste disposal in glaciofluvial terrain.

3.3 GLACIOLACUSTRINE LANDFORMS:

3.3.1 Description:

The only glaciolacustrine landform in the Batchawana map-area is the *raised beaches* (LB) along the Lake Superior shoreline. They were formed by the post-Algonquin glacial lake which, at its highest stage, was about 100 m above the present level of Lake Superior. These deposits of sand and gravel are mainly confind to lowland pockets surrounded by bedrock hills. Shoreline scarps, which mark levels of the former glacial lake, are quite evident on the airphotos and are shown graphically on the Data Base Map (OGS Map 5011, accompanying this report).

Materials are often sandy with variable amounts of gravel, although good areas of cobbly gravel do exist. A number of the deposits are potentially thick. A typical letter code describing these features is:

$$\frac{\text{sgLB}}{\text{Lst-D}}$$

It indicates that the landform is a lacustrine beach composed of sand and gravel, but likely containing more sand than gravel. The relief is low and the landform slopes gently in terraces toward Lake Superior. Surface materials are well drained and dry.

Just south of Montreal River Harbour, excellent examples of these features are protected for their historical significance in Montreal River Provincial Park.

3.3.2 Significance:

RESOURCES: The lacustrine beaches have good potential for providing sufficient sand and gravel aggregate and general borrow material for local use. Several pits have been developed in these deposits, the material extracted having been used for construction of roads and other engineering projects.

GENERAL CONSTRUCTION: These deposits are generally suitable for construction purposes. The materials excavate and grade easily, and foundations can be sited with minimal difficulty. Side slopes in deep

cuts may have zones of instability which will require benching and revegetation.

WASTE DISPOSAL: The sandy beach deposits are potentially suitable for the location of septic tile fields. However, the permeable materials in these landforms represent a constraint for sanitary landfills and liquid waste lagoons. Care must be taken to avoid contamination of both surface and ground waters. Subsurface investigations should be undertaken prior to the siting of any type of waste disposal facility.

3.4 ALLUVIAL AND ORGANIC LANDFORMS:

3.4.1 Description:

Alluvial plains (AP), many of them too small to be shown on the map, are associated with most rivers and streams in the Batchawana map-area. The alluvial materials are often derived from outwash deposits and thus, have a similar granular texture. The deposit along the lower Agawa River exemplifies this relationship and is symbolized by:

$$\frac{\text{sgAP(sgGO)}}{\text{Lct-M(D)}}$$

Here, the alluvial plain is composed of gravelly sand and, in places, is associated with terraces of sand and gravel outwash material. Relief is low and the feature is terraced and channeled by the river. Surface drainage is mixed wet and dry on the alluvial plain, whereas the outwash deposits are dry.

Organic deposits are sometimes associated with alluvial plains. Drainage conditions in this landform are often poor and flooding can occur. Many streams, especially the smaller ones, have sparse alluvial deposits and are often floored in bedrock.

Areas of *organic terrain* (OT) are widespread and are associated with depressions in the bedrock and poorly drained alluvial plains. In the latter case, a typical letter code is:

$$\frac{\text{pOT(sAP)}}{\text{Lp-W}}$$

The organic terrain consists of peat and the subordinate landform is a sandy alluvial plain. The unit has low relief, level topography, and generally wet surface drainage conditions.

3.4.2 Significance:

Development on alluvial plains will encounter many problems. Soft ground conditions, poor surface drainage, flooding, and high ground water levels are the main engineering constraints. There may be some potential for small scale extraction of granular materials, particularly in valleys containing outwash deposits.

Organic terrain presents many problems for most types of human activity and is generally unsuitable for development. The main problems for construction involve soft and highly compressible soils, flooding conditions, and poor accessibility.

4.0 SUMMARY OF ENGINEERING SIGNIFICANCE:

Most of the Batchawana map-area is comprised of rugged bedrock terrain. The bedrock presents major problems for all types of development. Areas providing the best conditions for general construction and development are the outwash and lacustrine beach landforms. These are concentrated in the western part of the map-area, near the shore of Lake Superior. The outwash and beach deposits also represent potential sources of sand and gravel. The best access routes through the bedrock terrain are provided by the major river valleys.

Table 1 is a summary of the general engineering significance of the more common terrain units found in the area. This table is intended only as a guide to help the reader in assessing the overall significance of the map-units. Site-specific work is necessary to better define actual ground conditions, such as drainage and slope, which are not considered in the table, but which may affect the engineering significance of the various terrain units.

TABLE 1: SUMMARY OF ENGINEERING SIGNIFICANCE

		BEDROCK	MORAINAL	GLACIOFLUVIAL		GLACIO-LACUSTRINE	ALLUVIAL	ORGANIC
		RN	tMG/R	sgGO	sgGE	sgLB	AP	pOT
RESOURCE POTENTIAL	SAND & GRAVEL	Poor	Poor	Good	Good	Fair to Good	Fair to Poor	Poor
	GROUND WATER	Poor	Poor	Good	Fair to Poor	Fair to Good	Fair	Poor
LIGHT CONSTRUCTION CONDITIONS	EXCAVATION	Blasting	Fair to Poor	Good	Fair to Good	Fair to Good	Poor	Poor
	FOUNDATION	Excellent	Good	Good	Fair to Good	Fair to Good	Poor	Poor
	GRADING	Difficult	Fair	Good	Good	Good	Fair	Poor
	MATERIAL RE-USE	Rockfill	Fair	Good	Good	Good	Fair	Poor
WASTE DISPOSAL SUITABILITY	SEPTIC SYSTEMS	Very Poor	Fair	Good	Fair to Poor	Good	Poor	Poor
	LANDFILL	Poor	Fair to Poor	Fair to Poor	Poor	Fair to Poor	Poor	Poor
	LAGOONS	Poor	Fair to Poor	Fair to Poor	Poor	Poor	Poor	Poor

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